UNITED STATES PATENT APPLICATION

SUNSCREENS BASED ON SUBSTITUTED HYDROCARBYL FUNCTIONAL SILOXANES FOR HOUSEHOLD, HEALTH, AND PERSONAL CARE APPLICATIONS

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CROSS REFERENCE

[0001] This application is a Continuation in Part of Application No. 10/157,639, filed May 28, 2002.

FIELD OF THE INVENTION

[0002] The present invention relates to a sunscreen composition containing a hydrocarbyl functional organopolysiloxane. The hydrocarbyl functional organopolysiloxane contains at least one siloxy unit of the formula $-R^2OCH_2CH_2OH$, where R^2 is a divalent hydrocarbon group containing 2 to 6 carbon atoms. The inclusion of the hydrocarbyl functional organopolysiloxane in the sunscreen composition improves the sun-protection factor (SPF) of the sunscreen component. The present invention also relates to various personal, medical and household care compositions containing the sunscreen composition.

BACKGROUND OF THE INVENTION

[0003] In the household, health and personal care areas, the need exists for silicone raw materials that contain both hydrophilic and hydrophobic functionality. To date, this need has been addressed with polyoxyalkylene and silanol functional silicone materials. In particular, there are numerous examples of the use of polyoxyalkylene functional silicones, also referred in the art as silicone polyethers and/or silicone glycols, in various personal, household, and healthcare applications.

[0004] Majority of the oxyalkylene functional silicones used in various personal, household, and healthcare applications contain polyoxyalkylene moieties, that is having multiple oxyalkylene units. This is most likely because of two reasons. First, majority of these oxyalkylene functional silicones have been used as surfactants in such applications. As analogous to hydrocarbon based polyoxyalkylene surfactants, multiple oxyalkylene units are needed to impart sufficient hydrophilicity for surfactant character. The amount of oxyalkylene units present in such surfactant molecules is often depicted as a HLB (hydro-lipophilic balance) value. Thus, polyoxyalkylene functional silicones with varying HLB's have found use in various personal, household, and healthcare applications where they function as surfactants and emulsifiers.

[0005] Secondly, the majority of the oxyalkylene functional silicones used in various personal, household, and healthcare applications contain polyoxyalkylene moieties because of the ready availability of the starting materials and synthetic ease of making allyloxypolyethers with that minimum substitution. Polyoxyalkylene functional silicones are usually prepared by hydrosilylation of an organohydrogensiloxane (SiH) and an olefinically substituted polyoxyalkylene. For example, the platinum catalyzed reaction of Si-H polymers with allyl ethers was disclosed in US Patent 2,823,218 (February 11, 1958). Typically, the smallest oxyalkylene substitutents used in such applications are EO_4 and PO_2. This is because of the ready availability of the starting materials and synthetic ease of making allyloxypolyethers with that minimum substitution.

[0006] US Patents 5,486,566 and 6,060,044 provide representative examples of the use of polyoxyalkylene functional silicones in various personal care formulations. The '566 patent describes siloxane gels for use in various personal care applications. The gel contains an amide-free gelator, a siloxane polyether for strengthening the gel, and a volatile methyl siloxane. While the '566 teaches the use of both oxyethylene units - $(C_2H_4O)_p$ - and

oxypropylene units - $(C_3H_6O)_s$ - for the polyether segments of the siloxane polyether, the oxypropylene based polyethers are preferred. US Patent 6,060,044 describes a cosmetic composition comprising in a cosmetically acceptable medium, at least one guar gum and at least one oxyalkylenated silicone in a guar gum/silicone weight ratio of less than or equal to 5:1.

[0007] Many of the existing polyoxyalkylene and silanol functional silicones possess inherent properties that limit their use in many household, health and personal care formulations. For example, existing polyoxyalkylene and silanol functional silicones have unpleasant aesthetics upon skin application from a formulation. Furthermore, many have limited stability in acid or basic formulations. Thus, there is a need for silicones having both polar and non-polar characteristics yet provide good aesthetics upon skin application and that are also stable in acidic and basic formulations.

[0008] The present inventors have discovered that the inclusion of a hydrocarbyl functional organopolysiloxane, in particular where the hydrocarbyl group has the formula – $R^2OCH_2CH_2OH$, where R^2 is a divalent hydrocarbon group containing 2 to 6 carbon atoms, results in personal care, medical and household care compositions with unique properties. In particular, the hydrocarbyl functional organopolysiloxanes are stable in acidic and basic formulations, and provide good aesthetics upon skin application.

[0009] In addition to the benefits described above, the present inventors discovered further unexpected benefits when the hydrocarbyl functional organopolysiloxanes were used in sunscreen formulations. In particular, the present inventors discovered the SPF of a sunscreen component can be improved by the addition of the hydrocarbyl functional organopolysiloxanes.

SUMMARY OF THE INVENTION

[0010] The present invention provides a sunscreen composition comprising;

(i) a hydrocarbyl functional organopolysiloxane comprising a siloxy unit of the formula $R^1 R_aSiO_{(3-a)/2}$ wherein

R is a monovalent hydrocarbon group,

R^1 is a hydrocarbyl group having the formula $-R^2OCH_2CH_2OH$,

R^2 is a divalent hydrocarbon group containing 2 to 6 carbon atoms,

a is zero to 2; and

(ii) a sunscreen agent.

[0011] This invention also relates to cosmetic, household, or health care formulations comprising the sunscreen composition of the present invention.

[0012] This invention further relates to a method of treating skin or hair for sun-protection comprising applying the inventive sunscreen compositions to skin.

[0013] This invention yet further relates to a method of improving the SPF of a sunscreen agent by mixing a sunscreen agent with the hydrocarbyl functional organopolysiloxanes taught herein.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The hydrocarbyl functional organopolysiloxane of the present invention comprises a siloxy unit of the formula $R^1 R_aSiO_{(3-a)/2}$ wherein R is any monovalent hydrocarbon group, but typically is an alkyl, cycloalkyl, alkenyl, aralkyl, or an aryl group containing 1-20 carbon atoms, R^1 is a hydrocarbyl group having the formula $-R^2OCH_2CH_2OH$, R^2 is a divalent hydrocarbon group containing 2 to 6 carbon atoms, a is zero to 2.

[0015] Organopolysiloxanes are well known in the art and are often designated as comprising any number of M units ($R_3SiO_{0.5}$), D units (R_2SiO), T units ($RSiO_{1.5}$), or Q units (SiO_2) where R is independently any monovalent hydrocarbon group. In the present invention, the organopolysiloxane has at least one hydrocarbyl substituent of the formula $-R^2OCH_2CH_2OH$, designated as R^1. The R^2 group in the hydrocarbyl substituent is a divalent hydrocarbon group containing 2 to 6 carbon atoms. The R^2 divalent hydrocarbon is represented by an ethylene, propylene, butylene, pentylene, or hexylene. Typically, the divalent hydrocarbon is a propylene group, $-CH_2CH_2CH_2-$.

[0016] The hydrocarbyl substituent is bonded to the organopolysiloxane via a Si-C bond. The hydrocarbyl substituent can be present in the organopolysiloxane via linkage to any organosiloxy unit, that is it may be present on any M, D, or T siloxy unit. In other words, the hydrocarbyl functional siloxy unit can be a M unit ($R^1R_2SiO_{0.5}$), a D unit (R^1RSiO), a T unit ($R^1SiO_{1.5}$), or a mixture of any of these. The hydrocarbyl functional organopolysiloxane can also contain any number of additional M, D, T, or Q siloxy units of the general formula ($R_3SiO_{0.5}$), (R_2SiO), ($RSiO_{1.5}$), or (SiO_2), providing that the organopolysiloxane has at least one siloxy unit with the R^1 present.

[0017] The weight average molecular weight (M_w) or number average molecular weight (M_N) of the hydrocarbyl functional organopolysiloxane can vary, and is not limiting. The hydrocarbyl functional organopolysiloxane can be either liquid or solid in form, but are generally liquids.

[0018] The amount of the hydrocarbyl functional groups present in the organopolysiloxanes of the present invention can vary, but typically ranges from 1 to 40 mass percent, alternatively from 5 to 30 mass percent, or alternatively from 10 to 20 mass percent of the total mass of the organopolysiloxane.

[0019] In one embodiment, the hydrocarbyl functional organopolysiloxane has a formula selected from the group:

$R_3SiO(RR^1SiO)_ySiR_3$,

$R_3SiO(R_2SiO)_x(RR^1SiO)_ySiR_3$,

$R^1R_2SiO(R_2SiO)_xSiR_2R^1$,

$R^1R_2SiO(RR^1SiO)_zSiR_2R^1$,

$R^1R_2SiO(R_2SiO)_x(RR^1SiO)_zSiR_2R^1$,

$R^1R_2SiO(R_2SiO)_xSiR_3$,

$R^1R_2SiO(RR^1SiO)_zSiR_3$,

$R^1R_2SiO(R_2SiO)_x(RR^1SiO)_zSiR_3$, and cyclic siloxanes of the formula

$-(Me_2SiO)_m(MeR^1SiO)_n-$.

[0020] In these formulas, R is an alkyl, cycloalkyl, alkenyl, aralkyl, or an aryl group containing 1-20 carbon atoms; R^1 is the hydrocarbyl group as defined above, x is 1-500, y is 1-40, z is 1-40, m is 1-6, n is 1-6, and the sum of m + n is 3-12.

[0021] In the alternate embodiment, the hydrocarbyl functional organopolysiloxane is a resin having the formula;

$$(SiO_2)_c(R^3SiO_{3/2})_d(R^3{}_2SiO)_e(R^3{}_3SiO_{1/2})_f\{O_{1/2}SiR^3{}_2R^4\}_g$$

where R^3 is an alkyl group with 1-20 carbon atoms, a cycloalkyl group with 3-20 carbon atoms, an alkenyl group with 2-20 carbon atoms, an aralkyl group, or an aryl group; R^4 is the same as R^1 above, i.e., one of the formulas (i) to (iv); and g is 1-15,000. In such resins, c, d, e, and f represent mole percents, such that $c < 100$, $c + d > 0$, and $c + d + e + f$ is 100. Organosiloxane resins of this type typically contain about 0.01-15 weight percent of silanol.

[0022] In a preferred embodiment, the hydrocarbyl functional organopolysiloxane has the formula

$$R^1Me_2SiO(Me_2SiO)_xSiMe_2R^1$$

where R^1 is $-(CH_2)_3OCH_2CH_2OH$ and x is 1 to 100, alternatively 5 to 50, or alternatively 10 to 20.

[0023] The hydrocarbyl functional organopolysiloxanes of the present invention can be made by standard processes such as the hydrosilylation of organohydrogensiloxanes and olefinically substituted polyoxyalkylenes. The hydrosilylation reaction is typically performed in a low molecular weight volatile hydrocarbon solvent such as benzene, toluene, xylene, or

isopropanol to aid in handling the reactants, to moderate an exothermic reaction or to promote the solubility of the reactants. Such processes are described, for example, in the '218 Patent noted above, which is incorporated herein by reference.

[0024] The sunscreen composition of the present invention also comprises a sunscreen agent. The sunscreen agent can be selected from any sunscreen agent known in the art to protect skin from the harmful effects of exposure to sunlight. The sunscreen can be an organic compound, an inorganic compound, or mixtures thereof. Thus, representative non limiting examples that can be used as the sunscreen agent include; Aminobenzoic Acid, Cinoxate, Diethanolamine Methoxycinnamate, Digalloyl Trioleate, Dioxybenzone, Ethyl 4-[bis(Hydroxypropyl)] Aminobenzoate, Glyceryl Aminobenzoate, Homosalate, Lawsone with Dihydroxyacetone, Menthyl Anthranilate, Octocrylene, Octyl Methoxycinnamate, Octyl Salicylate, Oxybenzone, Padimate O, Phenylbenzimidazole Sulfonic Acid, Red Petrolatum, Sulisobenzone, Titanium Dioxide, and Trolamine Salicylate.

[0025] The organic sunscreen compound is typically chosen from an organic compound that absorbs ultraviolet (UV) light. Some examples of UV light absorbing compounds are Acetaminosalol, Allatoin PABA, Benzalphthalide, Benzophenone, Benzophenone 1-12, 3-Benzylidene Camphor, Benzylidenecamphor Hydrolyzed Collagen Sulfonamide, Benzylidene Camphor Sulfonic Acid, Benzyl Salicylate, Bornelone, Bumetriozole, Butyl Methoxydibenzoylmethane, Butyl PABA, Ceria/Silica, Ceria/Silica Talc, Cinoxate, DEA-Methoxycinnamate, Dibenzoxazol Naphthalene, Di-t-Butyl Hydroxybenzylidene Camphor, Digalloyl Trioleate, Diisopropyl Methyl Cinnamate, Dimethyl PABA Ethyl Cetearyldimonium Tosylate, Dioctyl Butamido Triazone, Diphenyl Carbomethoxy Acetoxy Naphthopyran, Disodium Bisethylphenyl Tiamminotriazine Stilbenedisulfonate, Disodium Distyrylbiphenyl Triaminotriazine Stilbenedisulfonate, Disodium Distyrylbiphenyl Disulfonate, Drometrizole, Drometrizole Trisiloxane, Ethyl Dihydroxypropyl PABA, Ethyl Diisopropylcinnamate, Ethyl Methoxycinnamate, Ethyl PABA, Ethyl Urocanate, Etrocrylene Ferulic Acid, Glyceryl Octanoate Dimethoxycinnamate, Glyceryl PABA, Glycol Salicylate, Homosalate, Isoamyl p-Methoxycinnamate, Isopropylbenzyl Salicylate, Isopropyl Dibenzolylmethane, Isopropyl Methoxycinnamate, Menthyl Anthranilate, Menthyl Salicylate, 4-Methylbenzylidene, Camphor, Octocrylene, Octrizole, Octyl Dimethyl PABA, Octyl Methoxycinnamate, Octyl Salicylate, Octyl Triazone, PABA, PEG-25 PABA, Pentyl Dimethyl PABA, Phenylbenzimidazole Sulfonic Acid, Polyacrylamidomethyl Benzylidene Camphor, Potassium Methoxycinnamate, Potassium Phenylbenzimidazole Sulfonate, Red Petrolatum, Sodium Phenylbenzimidazole Sulfonate, Sodium Urocanate, TEA-

Phenylbenzimidazole Sulfonate, TEA-Salicylate, Terephthalylidene Dicamphor Sulfonic Acid, Titanium Dioxide, TriPABA Panthenol, Urocanic Acid, and VA/Crotonates/Methacryloxybenzophenone-1 Copolymer.

[0026] Alternatively, the sunscreen agent is a cinnamate based organic compound, or alternatively, the sunscreen agent is octyl methoxycinnamate, such as Uvinul® MC 80 an ester of para-methoxycinnamic acid and 2-ethylhexanol.

[0027] The sunscreen compositions according to the invention can be formed by combining the hydrocarbyl functional organopolysiloxane component and the sunscreen agent component, as described above, at a weight ratio of 1:99 to 99:1, alternatively 1:10 to 10:1, or alternatively from 1:2 to 2:1. Such compositions can generally be prepared at room temperature, using simple propeller mixers, Brookfield counter-rotating mixers, or homogenizing mixers. No special equipment or processing conditions are typically required.

[0028] Alternatively, the sunscreen compositions may contain a carrier. The carrier can be selected from any silicone or organic solvent, such as those described infra.

[0029] The sunscreen compositions of the present invention can be further combined with a personal care ingredient, household care ingredient, or health care ingredient. Such compositions can contain; (i) 0.1-99.9 percent of the hydrocarbyl functional organopolysiloxane fluid or the hydrocarbyl functional organopolysiloxane resin; (ii) 0.1 to 99.9 percent of the sunscreen agent; optionally (iii) 0.1-40 percent of a cosmetic active, household care active, or health care active; and (iv) the balance to 100 percent being water, an organic solvent, a silicone solvent, or one or more optional ingredients, depending upon the particular type of composition being prepared, and its intended end use or application. Generally, such compositions can generally be prepared at room temperature, using simple propeller mixers, Brookfield counter-rotating mixers, or homogenizing mixers. No special equipment or processing conditions are typically required.

[0030] As used herein, the terms personal care composition, health care composition, and household care composition are intended to mean typical materials commercially available as products or raw materials in consumer markets containing active and inactive ingredients.

[0031] The hydrocarbyl functional organopolysiloxanes are useful in a number of different products, including hair care products such as hairsprays, shampoos, mousses, styling gels and lotions, cream rinses/conditioners, hair tonics, hair dyes and colorants, permanent waves and bleaches. Also included are skin care products such as cleansers, moisturizers,

conditioners, lipsticks, eye makeup, foundations, fingernail polish, suntan products, antiperspirant/deodorant products and depilatories. Also included are household products such as waxes, polishes, heavy and light duty liquid cleaners, fabric softeners, ironing aids, laundry detergents, and window cleaners.

[0032] Some typical ingredients used in these products are surfactants, pigments, solvents, emollients, and carriers. For example, the solvents can include esters (for example, isopropyl myristate and C_{12-15} alkyl lactate), water, silicone fluids (for example, cyclomethicone, dimethicone), ethanol, isopropanol, guerbet alcohols having 8-30 carbons, particularly 12-22 carbons (for example, isolauryl alcohol, isocetyl alcohol, isostearyl alcohol), fatty alcohols (for example, stearyl alcohol, myristyl alcohol, oleyl alcohol), and ethoxylated and propoxylated alcohols (for example, the polyethylene glycol ether of lauryl alcohol that conforms to the formula $CH_3(CH_2)_{10}CH_2(OCH_2CH_2)_r$ OH where r has an average value of 4 (Laureth-4); PPG-14 butyl ether, where the "PPG-14" portion is the polymer of propylene oxide that conforms generally to the formula $H(OCH_2C(CH_3)H)_sOH$, where s has an average value of 14, or PPG-3 myristyl ether which is the polypropylene glycol ether of myristyl alcohol that conforms to the formula $CH_3(CH_2)_{12}CH_2(OCH(CH_3)CH_2)_tOH$ where t has an average value of 3, or a hydrocarbon fluid.

[0033] Hydrocarbon fluids are exemplified by organic hydrocarbon fluids such as halogenated hydrocarbon fluids, aliphatic hydrocarbon fluids, aromatic hydrocarbon fluids, and mixtures of aromatic and aliphatic hydrocarbon fluids. The hydrocarbon fluids usually contain about 6 to about 12 carbon atoms. Examples of suitable hydrocarbon fluids include perchloroethylene, benzene, xylene, toluene, mineral oil fractions, kerosenes, naphthas, and petroleum fractions. Particularly preferred are isoparaffinic hydrocarbon fluids exemplified by isoparaffin fluids available from Exxon Mobil Chemical Company, Houston, Tex. U.S.A, sold as Isopar® M Fluid (a C_{13}-C_{14} Isoparaffin), Isopar® C Fluid (a C_7-C_8 Isoparaffin), Isopar® E Fluid (a C_8-C_9 Isoparaffin), Isopar® G Fluid (a C_{10-11} Isoparaffin), Isopar® L Fluid (a C_{11}-C_{13} Isoparaffin), Isopar® H Fluid (a C_{11}-C_{12} Isoparaffin), and combinations thereof. Mixtures of solvents can also be used.

[0034] Another ingredient which can be used is an emollient, including compositions such as guerbet alcohols (such as isocetyl alcohol or isostearyl alcohol); esters (such as isopropyl palmitate, isopropyl isostearate, octyl stearate, hexyl laurate and isostearyl lactate); a liquid mixture of hydrocarbons which are liquids at ambient temperatures (such as petroleum

distillates and light mineral oils); ethanol; volatile and non-volatile silicone oils, highly branched hydrocarbons, and non-polar carboxylic acids. The emollients can be included in the compositions of the present invention in amounts within the range of 0.01-70%, preferably 0.1-25%, by weight, of the total weight of the composition.

[0035] The carrier can include a wide variety of conditioning materials, such as hydrocarbons, silicone fluids, and cationic materials. The carrier can include surfactants, suspending agents, thickeners etc. Various additional components useful in these compositions are described in US Patent 4,387,090 (June 7, 1983).

[0036] Topical cosmetic, and pharmaceutical compositions according to the invention can contain a carrier, but the carrier should be *cosmetically and/or pharmaceutically acceptable*, i.e., that it is suitable for topical application to the skin, has good aesthetic properties, is compatible with the siloxane copolymers of the present invention, and will not cause any safety or toxicity concerns. It can be formulated to include an emulsion as the carrier such as an oil-in-water emulsion, water-in-oil emulsion, water-in-oil-in-water emulsion, or oil-in-water-in-silicone oil emulsion.

[0037] Some other suitable topical carriers include anhydrous liquid solvents such as oils, alcohols, and silicones (e.g., mineral oil, ethanol, isopropanol, dimethicone, cyclomethicone, and the like); aqueous-based single phase solvents (e.g., where the viscosity of the solvent has been increased to form a solid or semi-solid by the addition of appropriate gums, resins, waxes, polymers, salts, and the like). However, the preferred cosmetically and/or pharmaceutically acceptable topical carrier is a hydroalcoholic system or an oil-in-water emulsion. When the carrier is an oil-in-water emulsion, it will include common ingredients generally used for preparing emulsions.

[0038] Some of the typical active ingredients used in products such as these are antiacne agents, anticaries agents, antidandruff agents, antifungal agents, antimicrobial agents, antioxidants, antiperspirant agents and deodorant agents, cosmetic biocides, external analgesics, oral care agents, oral care drugs, oxidizing agents, reducing agents, skin bleaching agents, skin protectants, sunscreen agents, UV light absorbing agents, enzymes, optical brighteners, fabric softening agents, and surfactants

[0039] Some examples of antiacne agents are Salicylic acid and Sulfur. Some examples of anticaries agents are Sodium Fluoride, Sodium Monofluorophosphate, and Stannous Fluoride. Some examples of antidandruff agents are Coal tar, Salicylic acid, Selenium Sulfide, Sulfur, and Zinc Pyrithione. Some examples of antifungal agents are Calcium Undecylenate, Undecylenic Acid, Zinc Undecylenate, and Povidone-Iodine. Some examples of

antimicrobial agents are Alcohol, Benzalkonium Chloride, Benzethonium Chloride, Hydrogen Peroxide, Methylbenzethonium Chloride, Phenol, Poloxamer 188, and Povidone-Iodine.

[0040] Some examples of antioxidants are Acetyl Cysteine, Arbutin, Ascorbic Acid, Ascorbic Acid Polypeptide, Ascorbyl Dipalmitate, Ascorbyl Methylsilanol Pectinate, Ascorbyl Palmitate, Ascorbyl Stearate, BHA, p-Hydroxyanisole, BHT, t-Butyl Hydroquinone, Caffeic Acid, Camellia Sinensis Oil, Chitosan Ascorbate, Chitosan Glycolate, Chitosan Salicylate, Chlorogenic Acids, Cysteine, Cysteine HCI, Decyl Mercaptomethylimidazole, Erythorbic Acid, Diamylhydroquinone, Di-t-Butylhydroquinone, Dicetyl Thiodipropionate, Dicyclopentadiene/t-Butylcresol Copolymer, Digalloyl Trioleate, Dilauryl Thiodipropionate, Dimyristyl Thiodipropionate, Dioleyl Tocopheryl Methylsilanol, Isoquercitrin, Diosmine, Disodium Ascorbyl Sulfate, Disodium Rutinyl Disulfate, Distearyl Thiodipropionate, Ditridecyl Thiodipropionate, Dodecyl Gallate, Ethyl Ferulate, Ferulic Acid, Hydroquinone, Hydroxylamine HCI, Hydroxylamine Sulfate, Isooctyl Thioglycolate, Kojic Acid, Madecassicoside, Magnesium Ascorbate, Magnesium Ascorbyl Phosphate, Melatonin, Methoxy-PEG-7 Rutinyl Succinate, Methylene Di-t-Butylcresol, Methylsilanol Ascorbate, Nordihydroguaiaretic Acid, Octyl Gallate, Phenylthioglycolic Acid, Phloroglucinol, Potassium Ascorbyl Tocopheryl Phosphate, Thiodiglycolamide, Potassium Sulfite, Propyl Gallate, Rosmarinic Acid, Rutin, Sodium Ascorbate, Sodium Ascorbyl/Cholesteryl Phosphate, Sodium Bisulfite, Sodium Erythorbate, Sodium Metabisulfide, Sodium Sulfite, Sodium Thioglycolate, Sorbityl Furfural, Tea Tree (Melaleuca Aftemifolia) Oil, Tocopheryl Acetate, Tetrahexyldecyl Ascorbate, Tetrahydrodiferuloylmethane, Tocopheryl Linoleate/Oleate, Thiodiglycol, Tocopheryl Succinate, Thiodiglycolic Acid, Thioglycolic Acid, Thiolactic Acid, Thiosalicylic Acid, Thiotaurine, Retinol, Tocophereth-5, Tocophereth-10, Tocophereth-12, Tocophereth-18, Tocophereth-50, Tocopherol, Tocophersolan, Tocopheryl Linoleate, Tocopheryl Nicotinate, Tocoquinone, o-Tolyl Biguanide, Tris(Nonylphenyl) Phosphite, Ubiquinone, and Zinc Dibutyldithiocarbamate.

[0041] Some examples of antiperspirant agents and deodorant agents are Aluminum Chloride, Aluminum Zirconium Tetrachlorohydrex GLY, Dichloro-m-Xylenol, Aluminum Chlorohydrate, Aluminum Zirconium Tetrachlorohydrex PEG, Aluminum Chlorohydrex, Aluminum Zirconium Tetrachlorohydrex PG, Aluminum Chlorohydrex PEG, Aluminum Zirconium Trichlorohydrate, Domiphen Bromide, Aluminum Chlorohydrex PG, Aluminum Zirconium Trichlorohydrex GLY, Hexachlorophene, Aluminum Dichlorohydrate,

Ammonium Phenolsulfonate, Ketoglutaric Acid, Aluminum Dichlorohydrex PEG, Benzalkonium Bromide, Lauryl Isoquinolinium Bromide, Aluminum Dichlorohydrex PG, Benzalkonium Cetyl Phosphate, Laurylpyridinium Chloride, Aluminum Lactate, Benzalkonium Chloride, Methylbenzethonium Chloride, Aluminum Phenolsulfonate, Benzalkonium Saccharinate, Phenol, Aluminum Sesquichlorohydrate, Benzethonium Chloride, Sodium Bicarbonate, Aluminum Sesquichlorohydrex PEG, Bromochlorophene, Sodium Phenolsulfonate, Aluminum Sesquichlorohydrex PG, Cetylpyridinium Chloride, Tricloban, Aluminum Sulfate, Chlorophyllin-Copper Complex, Triclosan, Aluminum Zirconium Octachlorohydrate, Chlorothymol, Zeolite, Aluminum Zirconium Octachlorohydrex GLY, Zinc Lactate, Aluminum Zirconium Pentachlorohydrate, Cloflucarban, Zinc Phenolsulfonate, Aluminum Zirconium Pentachlorohydrex GLY, Dequalinium Chloride, Zinc Ricinoleate, Aluminum Zirconium Tetrachlorohydrate, and Dichlorophene.

[0042] Some examples of cosmetic biocides are Aluminum Phenolsulfonate, Ammonium Phenolsulfonate, Bakuchiol, Benzalkonium Bromide, Benzalkonium Cetyl Phosphate, Benzalkonium Chloride, Benzalkonium Saccharinate, Benzethonium Chloride, Potassium Phenoxide, Benzoxiquine, Benzoxonium Chloride, Bispyrithione, Boric Acid, Bromochlorophene, Camphor Benzalkonium Methosulfate, Captan, Cetalkonium Chloride, Cetearalkonium Bromide, Cetethyldimonium Bromide, Cetrimonium Bromide, Cetrimonium Chloride, Cetrimonium Methosulfate, Cetrimonium Saccharinate, Cetrimonium Tosylate, Cetylpyridinium Chloride, Chloramine T, Chlorhexidine, Chlorhexidine Diacetate, Chlorhexidine Digluconate, Chlorhexidine Dihydrochloride, p-Chloro-m-Cresol, Chlorophene, p-Chlorophenol, Chlorothymol, Chloroxylenol, Chlorphenesin, Ciclopirox Olamine, Climbazole, Cloflucarban, Clotrimazole, Coal Tar, Colloidal Sulfur, o-Cymen-5-ol, Dequalinium Acetate, Dequalinium Chloride, Dibromopropamidine Diisethionate, Dichlorobenzyl Alcohol, Dichlorophene, Dichlorophenyl Imidazoldioxolan, Dichloro-m-Xylenol, Diiodomethyltolylsulfone, Dimethylol Ethylene Thiourea, Diphenylmethyl Piperazinylbenzimidazole, Domiphen Bromide, 7-Ethylbicyclooxazolidine, Fluorosalan, Formaldehyde, Glutaral, Hexachlorophene, Hexamidine, Hexamidine Diisethionate, Hexamidine Diparaben, Hexamidine Paraben, Hexetidine, Hydrogen Peroxide, Hydroxymethyl Dioxoazabicyclooctane, Ichthammol, Isopropyl Cresol, Lapyrium Chloride, Lauralkonium Bromide, Lauralkonium Chloride, Laurtrimonium Bromide, Laurtrimonium Chloride, Laurtrimonium Trichlorophenoxide, Lauryl Isoquinolinium Bromide, Lauryl Isoquinolinium Saccharinate, Laurylpyridinium Chloride, Mercuric Oxide, Methenamine,

Methenammonium Chloride, Methylbenzethonium Chloride, Myristalkonium Chloride, Myristalkonium Saccharinate, Myrtrimonium Bromide, Nonoxynol-9 Iodine, Nonoxynol-12 Iodine, Olealkonium Chloride, Oxyquinoline, Oxyquinoline Benzoate, Oxyquinoline Sulfate, PEG-2 Coco-Benzonium Chloride, PEG-10 Coco-Benzonium Chloride, PEG-6 Undecylenate, PEG-8 Undecylenate, Phenol, o-Phenylphenol, Phenyl Salicylate, Piroctone Olamine, Sulfosuccinylundecylenate, Potassium o-Phenylphenate, Potassium Salicylate, Potassium Troclosene, Propionic Acid, PVP-Iodine, Quaternium-8, Quaternium-14, Quaternium-24, Sodium Phenolsulfonate, Sodium Phenoxide, Sodium o-Phenylphenate, Sodium Shale Oil Sulfonate, Sodium Usnate, Thiabendazole, 2,2'-Thiobis(4-Chlorophenol), Thiram, Triacetin, Triclocarban, Triclosan, Trioctyldodecyl Borate, Undecylenamidopropylamine Oxide, Undecyleneth-6, Undecylenic Acid, Zinc Acetate, Zinc Aspartate, Zinc Borate, Zinc Chloride, Zinc Citrate, Zinc Cysteinate, Zinc Dibutyldithiocarbamate, Zinc Gluconate, Zinc Glutamate, Zinc Lactate, Zinc Phenolsulfonate, Zinc Pyrithione, Zinc Sulfate, and Zinc Undecylenate.

[0043] Some examples of external analgesics are Benzyl Alcohol, Capsicum Oleoresin (Capsicum Frutescens Oleoresin), Methyl Salicylate, Camphor, Phenol, Capsaicin, Juniper Tar (Juniperus Oxycedrus Tar), Phenolate Sodium (Sodium Phenoxide), Capsicum (Capsicum Frutescens), Menthol, Resorcinol, Methyl Nicotinate, and Turpentine Oil (Turpentine).

[0044] Some examples of oral care agents are Aluminum Fluoride, Dicalcium Phosphate Dihydrate, Sodium Bicarbonate, Ammonium Fluoride, Domiphen Bromide, Sodium Chloride, Ammonium Fluorosilicate, Ferric Glycerophosphate, Sodium Fluoride, Ammonium Monofluorophosphate, Glycerin, Sodium Fluorosilicate, Ammonium Phosphate, Hexetidine, Sodium Glycerophosphate, Calcium Carbonate, Hydrated Silica, Sodium Metaphosphate, Calcium Fluoride, Hydrogenated Starch Hydrolysate, Sodium Monofluorophosphate, Calcium Glycerophosphate, Hydrogen Peroxide, Sodium Phytate, Calcium Monofluorophosphate, Hydroxyapatite, Sodium Styrene/Acrylates/Divinylbenzene, Calcium Phosphate, Magnesium Fluoride, Calcium Pyrophosphate, Magnesium Fluorosilicate, Stannous Fluoride, Cetylamine Hydrofluoride, Magnesium Glycerophosphate, Stannous Pyrophosphate, Cetylpyridinium Chloride, Manganese Glycerophosphate, Strontium Acetate, Chlorohexidine, Olaflur, Strontium Chloride, Chlorohexidine Diacetate, Phytic Acid, Tetrapotassium Pyrophosphate, Chlorohexidine Digluconate, Polyethylene, Tetrasodium Pyrophosphate, Chlorohexidine Dihydrochloride, Potassium Fluoride, Tricalcium Phosphate, Chlorothymol, Potassium Fluorosilicate, Zinc Chloride, Dequalinium Chloride, Potassium

Glycerophosphate, Zinc Citrate, Diammonium Phosphate, Potassium Monofluorophosphate, Zinc Sulfate, and Dicalcium Phosphate.

[0045] Some examples of oral care drugs are Ammonium Alum, Potassium Alum, Benzyl Alcohol, Carbamide Peroxide, Elm Bark Extract, Gelatin, Glycerin, Hydrogen Peroxide, Menthol, Pectin, Phenol, Sodium Bicarbonate, Sodium Perborate, and Zinc Chloride.

[0046] Some examples of oxidizing agents are Ammonium Persulfate, Calcium Peroxide, Hydrogen Peroxide, Magnesium Peroxide, Melamine Peroxide, Potassium Bromate, Potassium Caroate, Potassium Chlorate, Potassium Persulfate, Sodium Bromate, Sodium Carbonate Peroxide, Sodium Chlorate, Sodium Iodate, Sodium Perborate, Sodium Persulfate, Strontium Dioxide, Strontium Peroxide, Urea Peroxide, and Zinc Peroxide.

[0047] Some examples of reducing agents are Ammonium Bisufite, Ammonium Sulfite, Ammonium Thioglycolate, Ammonium Thiolactate, Cystemaine HCl, Cystein, Cysteine HCl, Ethanolamine Thioglycolate, Glutathione, Glyceryl Thioglycolate, Glyceryl Thioproprionate, Hydroquinone, p-Hydroxyanisole, Isooctyl Thioglycolate, Magnesium Thioglycolate, Mercaptopropionic Acid, Potassium Metabisulfite, Potassium Sulfite, Potassium Thioglycolate, Sodium Bisulfite, Sodium Hydrosulfite, Sodium Hydroxymethane Sulfonate, Sodium Metabisulfite, Sodium Sulfite, Sodium Thioglycolate, Strontium Thioglycolate, Superoxide Dismutase, Thioglycerin, Thioglycolic Acid, Thiolactic Acid, Thiosalicylic Acid, and Zinc Formaldehyde Sulfoxylate.

[0048] An example of a skin bleaching agent is Hydroquinone.

[0049] Some examples of skin protectants are Allantoin, Aluminum Acetate, Aluminum Hydroxide, Aluminum Sulfate, Calamine, Cocoa Butter, Cod Liver Oil, Colloidal Oatmeal, Dimethicone, Glycerin, Kaolin, Lanolin, Mineral Oil, Petrolatum, Shark Liver Oil, Sodium Bicarbonate, Talc, Witch Hazel, Zinc Acetate, Zinc Carbonate, and Zinc Oxide.

[0050] Compositions prepared according to the invention can be used in various over-the-counter (OTC) personal care compositions, health care compositions, and household care compositions, but especially in the personal care arena. Thus, they can be used in antiperspirants, deodorants, skin creams, skin care lotions, moisturizers, facial treatments such as acne or wrinkle removers, personal and facial cleansers, bath oils, perfumes, colognes, sachets, sunscreens, pre-shave and after-shave lotions, liquid soaps, shaving soaps, shaving lathers, hair shampoos, hair conditioners, hair sprays, mousses, permanents, depilatories, hair cuticle coats, make-ups, color cosmetics, foundations, blushes, lipsticks, lip

balms, eyeliners, mascaras, oil removers, color cosmetic removers, nail polishes, and powders.

EXAMPLES

[0051] The following examples are presented to further illustrate the compositions and methods of this invention, but are not to be construed as limiting the invention. All parts and percentages in the examples are on a weight basis and all measurements were obtained at about 23°C, unless indicated to the contrary.

[0052] In the representative examples that follow, the ingredient listed as "Carbinol fluid" is Dow Corning® 5562 Carbinol fluid (Dow Corning Corporation, Midland MI), a hydrocarbyl functional organopolysiloxane having the formula, $R^1Me_2SiO(Me_2SiO)_xSiMe_2R^1$ where R^1 is $-(CH_2)_3OCH_2CH_2OH$, and x is such to provide the product with a viscosity of about 50 cS (mm^2/s) at 23°C.

[0053] The Sun Protection Factors (SPF) of two sunscreen formulations were evaluated, one with and one without Carbinol Fluid. Dow Corning® 200 fluid (5 cS fluid) was used in the comparison formulation. The sunscreen formulations were prepared as follows. A 200-gram batch was made of each formulation, as summarized in Table 1 and 2. Phase A was mixed in a 1000 mL, tall baffled beaker. Phase B was mixed then a separatory funnel was used to add B to A at a very slow rate. A dual configuration of 4-blade pitched, and 6-blade turbine impellers at speeds up and 1300 rpm was used to mix phase A as B was added.

[0054] The SPF of each formulation was evaluated using a Labsphere Transmittance Analyzer. This technique measures the diffuse transmittance of sunscreens in the ultraviolet region (250-400 nm) using a dual diode array spectrometer with a xenon flash lamp (optimized for UV emission) and an integrating sphere enables instantaneous spectral acquisition. The instrument software converts amount of UV light transmitted through the sunscreen to SPF (Sun Protective Factor) and automatically calculates the average value of UVB (280-315 nm) and UVA (315-400 nm). The procedure used is summarized as follows.

Silanized Quartz Sample Preparation Procedure
for SPF analysis on the
Labsphere Transmittance Analyzer

1. Weigh a clean silanized quartz plate using an analytical balance (4 place).
2. Place the quartz plate on a draw down coater using a 0.5 or 1 mil draw down rod.
3. Apply ~0.4g across the top of the quartz glass near the draw down rod in a bead like fashion.
4. Pull the draw down lever down on top of the quartz plate.
5. With steady movement, pull towards you the draw down handle until the plate is fully coated with sample.
6. Remove the plate and weigh, record the weight.
7. Allow the coated plate to dry for 20 minutes.
8. Reweigh the coated plate and record weight.
9. Using a clean silanized quartz plate, run a blank using a Labsphere Ultraviolet Transmittance Analyzer set at 4 averaged readings.
10. Set the analyzer to 9 reading locations.
11. Input sample information.
12. Set analysis to read in absorbance, automatic scale.
13. Analyze the coated plate for SPF value.

Table 1

	Sunscreen Lotion with Carbinol Fluid	INCI Name	Wt. %	Trade Name/Supplier
	Phase A			
1	5562 Carbinol Fluid		7.00	Dow Corning®
2	5200 Si Formulation Aid	Lauryl PEG/PPG-18/18 Methicone	6.00	Dow Corning®
3	2502 Cosmetic Fluid	Cetyl Dimethicone	3.00	Dow Corning®
4	245 Fluid	Cyclopentasiloxane	6.00	Dow Corning®
5	Uvinul® MC80	Ethylhexyl Methoxycinnamate	7.50	BASF Corporation
	Phase B			
8	Sodium Chloride Certified A.C.S.	Sodium Chloride	2.00	Fisher Scientific
9	Deionized Water	Na	65.10	na
10	Glycerin	Glycerin	3.00	Fisher Scientific
11	Germaben II	Propylene Glycol and Diazolidinyl Urea and Methylparaben and Propylparaben	0.4	ISP, Sutton Laboratories
12	Totals		100.000	

Table 2

	Sunscreen Lotion with Dow Corning 200 Fluid 5 cSt	INCI Name	Wt. %	Trade Name/Supplier
	Phase A			
1	200 Fluid, 5 cSt	Dimethicone	7.00	Dow Corning®
2	5200 Si Formulation Aid	Lauryl PEG/PPG-18/18 Methicone	6.00	Dow Corning®
3	2502 Cosmetic Fluid	Cetyl Dimethicone	3.00	Dow Corning®
4	245 Fluid	Cyclopentasiloxane	6.00	Dow Corning®
5	Uvinul® MC80	Ethylhexyl Methoxycinnamate	7.50	BASF Corporation
	Phase B			
8	Sodium Chloride Certified A.C.S.	Sodium Chloride	2.00	Fisher Scientific
9	Deionized Water	na	65.10	na
10	Glycerin	Glycerin	3.00	Fisher Scientific
11	Germaben II	Propylene Glycol and Diazolidinyl Urea and Methylparaben and Propylparaben	0.4	ISP, Sutton Laboratories
12	Totals		100.000	

[0055] The carbinol fluid based formulation had an average SPF of 23 whereas the formulation based on a 5 cS polydimethylsiloxane had an average SPF value of 17.

[0056] Other variations may be made in compounds, compositions, and methods described herein without departing from the essential features of the invention. The embodiments of the invention specifically illustrated herein are exemplary only and not intended as limitations on their scope except as defined in the appended claims.